the upper side due to the layer removal at the lower side is in general not of the same shape as that released in the layer unless the stress can be expressed by a single term of the series expansion. The residual stress computed by the stretch-bending model can be obtained by substituting eq (11) into eq (1). The results of calculation for several combinations of the residual-stress distributions and specimen dimensions are shown in Figs. 3 and 4. It is seen that the stress amplitude is a function of both h/L and a/L. It is also seen that decreasing h/L has the same effect on the magnitude of the stress as does increasing a/L. Indeed, it may be shown that for most practical cases where the values of h/L and a/L are small, the error introduced by the stretch-bending model on the amplitude of the stress depends only on the h/a ratio. Figure 5 shows the error as a function of h/a, which increases dramatically when h/a is larger than unity.

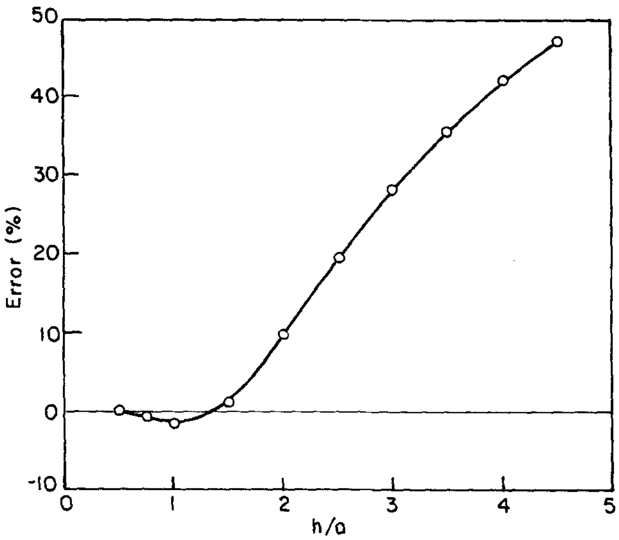

Fig. 5—The influence of h/a on the error resulting from the layer-removal method

Conclusion

An analytic solution has been derived as the exact computational model for the layer-removal method. This solution allows a direct examination of the validity of the stretch-bending model for measuring localized residual stresses. It is shown that the error produced by the stretch-bending model depends on the ratio of the height of the body to the dimension of the residual-stress zone. When the ratio of h/a is larger than one the error increases rapidly. In other words, the stretch-bending model for computing residual stresses due to welding is valid only if the height of a specimen is equal to or less than about half of the axial extent of large localized residual stresses. The present analysis discusses only the case for the first layer removal. However, it is expected that for multiple layer removals the error in each subsequent removal, though decreasing, would accumulate. It is, therefore, a good practice to use first the splitting method[2] to make the h/a ratio small enough before using the layer-removal method. However, the splitting method itself is subject to the limitations we have outlined.

References

1. *Shealy, W.D., Shadley, J.R. and Rybicki, E.F., "An Improved Back Computation Procedure for the 'Parting-Out' Step of a Destructive Method for Measuring Residual Stresses in Pipe," Strain,* **20** *(3), 117-122 (1984).*

2. *Rybicki, E.F., Shadley, J.R. and Shealy, W.S., "A Consistent-splitting Method for Experimental Residual-stress Analysis,"* EXPERIMENTAL MECHANICS, **23** *(4), 438-445 (1983).*

3. *Letner, H.R., "Application of Optical Interference to the Study of Residual Surface Stresses," Proc. SESA,* **X** *(2), (1953).*

4. *Leeser, D.O. and Daane, R.A., "Residual Stresses in a Strip in Terms of Strain Changes During Electro-Polishing," Proc. SESA,* **XII** *(1), (1954).*

5. *Timoshenko, S.P. and Goodier, J.N., Theory of Elasticity, Third Ed., McGraw-Hill Book Co., 53 (1970).*

Errata:

"Resistance-foil Strain-gage Technology as Applied to Composite Materials," by M.E. Tuttle and H.F. Brinson, **24** (1), 54-56 (March 1984). Two errors have been discovered by the authors in the subject article.

Page 59. In the discussion describing the effects of strain-gage transverse sensitivity on strain measurements, transverse sensitivity is considered for two distinct gage/fiber orientations, referred to as "Orientation I" and "Orientation II." The axial and transverse strains for Orientation I are erroneously calculated as:

$$\epsilon_a = \sigma_x[\bar{S}_{11} \cos^2\theta + \bar{S}_{12} \sin^2\theta + 2\bar{S}_{16} \cos\theta \sin\theta]$$

$$\epsilon_t = \sigma_x[\bar{S}_{11} \sin^2\theta + \bar{S}_{12} \cos^2\theta - 2\bar{S}_{16} \cos\theta \sin\theta]$$

The correct expressions are:

$$\epsilon_a = \sigma_x[\bar{S}_{11} \cos^2\theta + \bar{S}_{12} \sin^2\theta + \bar{S}_{16} \cos\theta \sin\theta]$$

$$\epsilon_t = \sigma_x[\bar{S}_{11} \sin^2\theta + \bar{S}_{12} \cos^2\theta - \bar{S}_{16} \cos\theta \sin\theta]$$

As indicated in the original paper, ϵ_a and ϵ_t for Orientation II correspond to ϵ_t and ϵ_a for Orientation I, respectively.

This error affects Figs. 4, 5, and 6. Figures 4(a) and 5(a) below show corrected results. The conclusions reached in the original paper are still valid, i.e., the effects of transverse sensitivity are quite severe for strain gages in the Orientation I configuration.

Page 62. The second error occurs in Fig. 10. The "ERROR IN STRAIN MEASUREMENT" in this figure should range from −600 to +700, rather than −60 to +70. The shape of the curves is correct. Thus, the error in transverse-strain measurement due to misalignment of a transverse gage is numerically equal to the error in axial-strain measurement due to an identical misalignment of an axial gage. (Compare the corrected Fig. 10 with Fig. 8.) However, the percentage error is much higher in the transverse case than in the axial case. (Compare Figs. 11 and 9.)

The authors regret these errors and hope this discussion has eliminated any confusion which may have arisen.

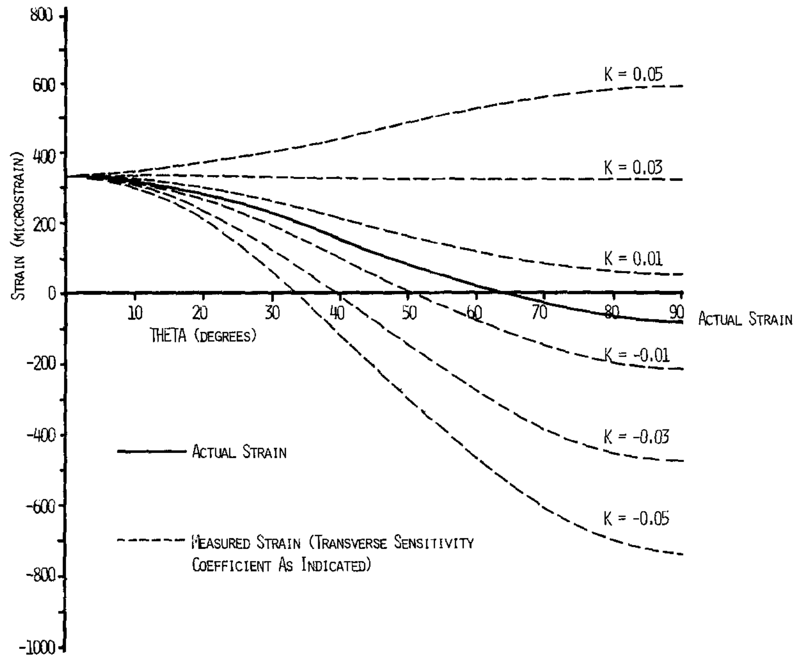

Fig. 4(a)—Error due to transverse sensitivity for graphite-epoxy orientation I

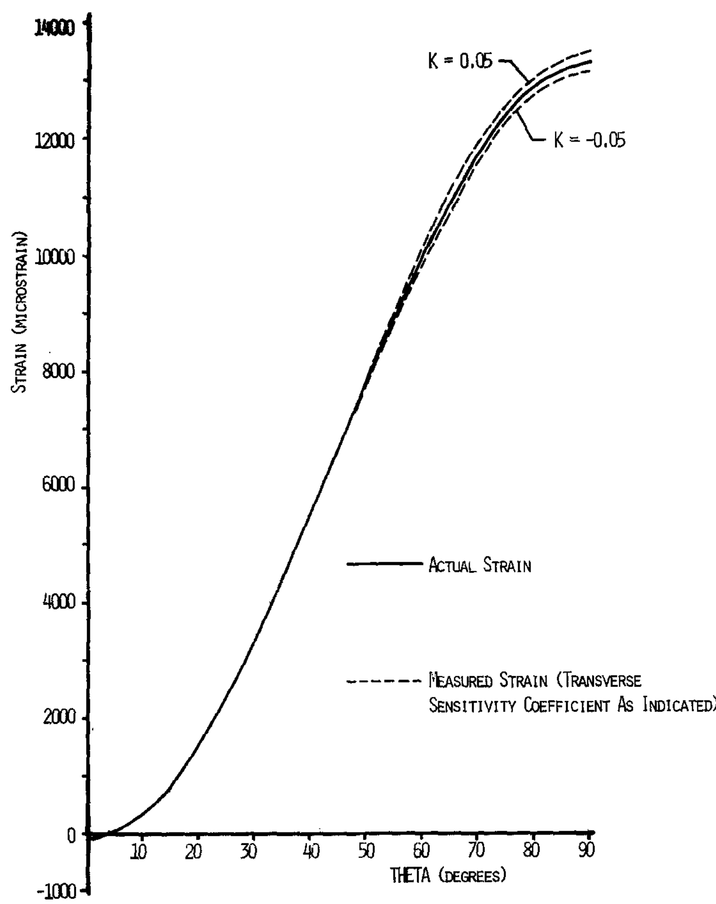

Fig. 5(a)—Error due to transverse sensitivity for graphite-epoxy orientation II